

# NEW\_HYPERZ (v12.2)

## NEW\_HYPERZ : AN OVERVIEW

---

The New\_Hyperz code is an updated version of the public code « Hyperz » originally described in Paper I (Bolzonella, Miralles & Pello, 2000, [A&A 363, 476-492](#)), distributed at <http://webast.ast.obs-mip.fr/hyperz/>. The new version v12.2 presently under development is intended to improve several aspects of the algorithm as described below. The algorithm is written in fortran. In addition to the photometric-redshift code, the final package should include different libraries of templates (galaxies, stars and QSO), both synthetic and empirical, and a library of filter transmissions.

The New\_Hyperz algorithm is based on the SED fitting procedure using a standard  $\chi^2$  minimization procedure. The observed SED of a given galaxy is compared to a set of template spectra as follows :

$$\chi^2(z) = \sum_{i=1}^{N_{\text{filters}}} \left[ \frac{F_{\text{obs},i} - b \times F_{\text{temp},i}(z)}{\sigma_i} \right]^2,$$

where  $F(\text{obs})$ ,  $F(\text{temp})$  and  $\sigma$  are the observed and template fluxes and their uncertainty in filter  $i$ , respectively, and  $b$  is a normalization constant. Figure 1 below presents the flow chart of the algorithm. The basic User's Manual can be found at <http://webast.ast.obs-mip.fr/newhyperz/> in html version, and an updated version is given with the distribution ([hyperz\\_manual1.2.pdf](#)). Only the modification introduced in versions v10 to v12 are described below.

## NEW\_HYPERZ v12.0 to v12.2 UPDATES

---

The differences of the released v12 with respect to the standard package are the following:

1. The new parameter's file is : `new_hyperz.param` . When running the code, a `[ ].hyperz` file is created to backup the current parameters.
2. Output file `[ ].header_zphot` provides the header content for `[ ].z_phot` file.
3. **Compilation update :**
  - The file *Makefile* contains the procedure for compilation. Just run :
    - `make new_hyper`
    - `make make_catalog`
    - `make clean`
  - The dimension of the hypercube can be modified by changing the dimension file `dimension.dec` as follows:

Present values:

PARAMETER (`mxz=305,mxage=51,mxtyp=15,mxfil=15,mxred=18,`

`mxlyf=3,mxwl=4000`)

i.e.: up to `mxz=305` redshift spets (usual ranges : `z=0-6, dz=0.02`)

up to mxage=51 (optimum value for Bruzual & Charlot templates)  
 up to mxtyp=15 templates => modify if needed  
 up to mxfil=15 filters => modify if needed  
 up to mxred=18 reddening steps => modify if needed  
 up to mxlyf=3 lyman forest opacities (allowed values = 1 to 3)  
 up to mxwl=4000 points per template => modify if needed

4. **New templates** : Version v11 and later are able to read Maraston templates, in addition to the usual Bruzual & Charlot (BC), Starburst99 (S), and ascii templates (AS) distributed in the initial version. Maraston templates should be identified as "MA" in the templates's file, e.g.:

```
csp_e0.10_z02_salp.sed_agb      MA
csp_e0.25_z02_salp.sed_agb     MA ...
```

Versions v10 and later are able to read Starburst99 models: flag "S" (same syntax as above)

5. **Filter transmissions** : The new FILTERS\_FILE input file includes an additionnal (#6) column allowing the combination of filters with T(lambda) given in energy AND in photons within the same input catalog. The value of this column should be = 1 (if T(lambda) is in % of energy) or =2 (if T(lambda) is in % of photons). Default value =2 (in versions v10 and later).
6. **Absolute magnitudes** : Up to 10 output filters can be requested when computing absolute magnitudes for the best fit, instead of a single filter in the previous version. The first filter is still the "reference" for M\_ABS\_MIN and M\_ABS\_MAX. The syntax is as follows :

```
FILT_M_ABS  91,224,225,226,227,228  # filter for absolute magnitude
```

7. **Scaling modes for absolute magnitudes** : There are 2 scaling modes for absolute magnitudes:

```
MSCALE_FILT_M_ABS  1 # 1: Absolute magnitude scaled to the "reference" filter (default;
                    compatible with previous versions)
                    2 # Global scaling according to best-fit template, irrespective of
                    the "reference" filter
```

8. **Galactic de-reddening** : A new option is introduced allowing to ingest an E(B-V) value for each object in the input catalogue, in addition to the usual one. This new parameter is EBV\_unit should be set to a value >0 to indicate the existence of an extra column in the input catalog where this information is found. This option is useful for large catalogs covering a wide area on the sky, as for EUCLID data. The new\_hyperz.param file reads as follows :

```
EBV_MW          0.00897 # E(B-V) for galactic dereddening
EBV_unit        0 # >0, read galactic E(B-V) for each object in input catalog
                # = 0: no E(B-V) column is provided
```

9. **Classification of extragalactic sources** is activated by the optional parameter REF\_TEMPLATES\_FILE . This parameter introduces a list of ASCII reference templates (default value, the CWW + a Kinney starburst). When this parameter is activated, in addition to the usual hyperz output, the \*.z\_phot file contains 1 + N(templates) additional columns with the following information:
  - 1- Best fit reference template (value ranging from 1 to N(templates))
  - 2- Reduced xi2 for the best fit with each reference template at the z\_best redshift.
 These are THE LATEST COLUMNS in the .z\_phot file if this option is activated. Example of use :

```
REF_TEMPLATES_FILE  reference_spectra.param # "Reference" ASCII templates
```

